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I HEREBY CERTIFY that annexed hereto is a true copy of documents filed in connection with the following patent application:

Application No.	S990560
Date of Filing	6 July 1999
Applicant	JOSEPH FREDERICK FRITSCH, a U.S. Citizen of 21 The Sweepstakes, Ballsbridge, Dublin 4, Ireland & ROXANNE YVONNE FRITSCH, a U.S. Citizen of 21 The Sweepstakes, Ballsbridge, Dublin 4, Ireland.

Dated this 27 day of July, 2000.

Richard O'Callaghan

An officer authorised by the
Controller of Patents, Designs and Trademarks.

FORM NO. 1

S990560

REQUEST FOR THE GRANT OF A PATENT

PATENTS ACT, 1992

The Applicant(s) named herein hereby request(s)

[ ] the grant of a patent under Part II of the Act

[X] the grant of a short-term patent under Part III of the Act

on the basis of the information furnished hereunder.

1. Applicant(s)

Name	JOSEPH FREDERICK FRITSCH and ROXANNE YVONNE FRITSCH
Address	Both of 21 The Sweepstakes, Ballsbridge, Dublin 4, Ireland.
Description/Nationality	Both U.S. Citizens.

2. Title of Invention "A cleaning device"

3. Declaration of Priority on basis of previously filed application(s) for same invention (Sections 25 & 26)

Previous filing date	Country in or for which filed	Filing No.

4. Identification of Inventor(s)

Name(s) of person(s) believed by Applicant(s) to be the inventor(s)

JOSEPH FREDERICK FRITSCH and ROXANNE YVONNE FRITSCH

Address

Both of 21 The Sweepstakes, Ballsbridge, Dublin 4, Ireland.

Both U.S. Citizens.

CONTINUED OVER

5. Statement of right to be granted a patent (Section 17 (2) (b))

6. Items accompanying this Request - tick as appropriate

(i) [x] Prescribed filing fee (£ 50.00)

(ii) [ ] Specification containing a description and claims

[x] Specification containing a description only

[x] Drawings referred to in description or claims

(iii) [ ] An abstract

(iv) [ ] Copy of previous application(s) whose priority is claimed

(v) [ ] Translation of previous application whose priority is claimed

(vi) [ ] Authorisation of Agent (this may be given at 8 below if this Request is signed by the Applicant(s))

7. Divisional Application(s)

The following information is applicable to the present application which is made under Section 24 -

Earlier Application No: .....
Filing Date: .....

8. Agent

The following is authorised to act as agent in all proceedings connected with the obtaining of a patent to which this request relates and in relation to any patent granted -

Name	**Address**
F.F. GORMAN & CO.	54 Merrion Square, Dublin 2, Ireland.

9. Address for Service (if different from that at 8)

F.F. GORMAN & CO., at its address as recorded for the time being in the Register of Patent Agents.

F.F. GORMAN & CO., Authorised Patent Agents

BY: _____ EXECUTIVE

Signed Name(s) :
Capacity(ies) applicant(s) or body corporate)

Date July 6. 1999

"A cleaning device"

The present invention relates to a cleaning device, and in particular, to a cleaning device for cleaning a portion of an interface means, for example, a component of a read and/or write head of a read and/or write unit of the type in which the interface means is provided for reading and/or writing data from or to a data carrier, such as, for example, a floppy disc, an optical disc, a data cartridge unit or the like.

In this specification the term read and/or write unit is used in this specification to include at least the following within its means, an optical disc drive unit, for example, a compact disc player and/or recorder unit, a CD ROM read and/or write drive unit, a floppy disc drive, a tape drive unit, for example, a magnetic tape drive unit, such as, a tape cassette player and/or recorder, a tape cassette read and/or write unit, or a data cartridge tape drive unit. The term interface means is used in this specification to mean any type of interface which interfaces with a data carrier in a read and/or write unit for reading from and/or writing to the data carrier. Such an interface means would at least include a read and/or write head, which may be a magnetic head or an optical head, or a combination of both. Such read and/or write units typically are provided with a receiving area for receiving the data carrier which may be, for example, a floppy disc, an optical disc, a tape cassette or a data carrier tape cassette. The interface means, typically is located in or adjacent the receiving area for interfacing with the data carrier for in turn reading and/or writing data to or from the data carrier. Such read and/or write units may be suitable for receiving data

carriers on which the data is stored in digital and/or analogue form and may be for music and/or computer data, or otherwise.

Such read and/or write units are well known. As discussed above, the interface means, typically, a read and/or write head are located in or adjacent the receiving area for receiving the data carrier. In the case of an optical disc drive unit of the type for reading and/or writing onto a CD ROM disc, and in the case of an optical disc drive unit of the type for playing from and/or recording onto a compact disc, the read/write head is provided by an optical head which comprises a laser light source which directs a laser light beam onto the disc for reading and/or writing from or to the disc. The laser light beam is focused onto the disc by a focusing lens. The optical head, and in particular, the lens of the optical head is prone to collecting dirt, dust, and other debris. The collection of dirt and dust on the lens of the optical head significantly reduces the efficiency of the optical disc drive unit. Indeed, when excessive dirt or dust has collected on the lens, the optical disc unit becomes inoperative. This, is due to the fact that the optical disc drive unit will only commence rotation of an optical disc in the disc receiving area after the optical head has detected the presence of a disc in the disc receiving area. If the lens is excessively dirty the optical head is unable to detect the presence of a disc. Furthermore, before the optical head is moved relative to the disc, typically, to the appropriate track on the disc which is to be read, the optical head must be able to read sufficient information from the optical disc to permit the optical head to be moved. Thus, a dirty lens causes failure of the head to move from its inner rest location. In the event of excessive dirt collection on the lens the disc drive unit fails to rotate the optical disc.

Cleaning devices for cleaning the lens of the optical head of an optical disc drive unit are known. However, in general, such cleaning devices require relative movement between the optical head and the disc, and this relative movement, in general, is achieved by rotation of the optical disc. In general, movement of the optical head from its inner rest position is also required. It will therefore be appreciated that such cleaning devices are unsuitable in the case of excessively dirty lenses.

Similar problems may arise in the case of magnetic disc drive units, where the magnetic head can become excessively soiled.

There is therefore a need for a cleaning device for cleaning the lens of an optical head of an optical disc drive unit which is suitable for cleaning a relatively dirty lens. There is also a need for a cleaning device for cleaning a component of a read and/or write head or any other interface means of a read and/or write unit.

According to the invention there is provided a cleaning device for cleaning a component of an interface means of the type hereinbefore defined of a read and/or write unit of the type hereinbefore defined, the read and/or write unit comprising a receiving area for receiving a data carrier, the interface means being located in or adjacent the receiving area for interfacing with the data carrier for reading from and/or writing to the data carrier, the cleaning device comprising a carrier means for engaging in the receiving area of the read and/or write unit, and a cleaning means carried on the carrier means for cleaning the

component of the interface means when the carrier means is engaged in the receiving area, the cleaning means being located on the carrier means so that when the carrier means is engaged in the disc receiving area and aligned with the component to be cleaned movement of the interface means during adjustment of the interface means by the read and/or write unit relative to the carrier means for attempting to read the carrier means, the interface means urges the component relative to the cleaning means for wiping of the component.

In one embodiment of the invention the cleaning means is located on the carrier means at a location which when the cleaning device is located in the receiving area the cleaning means is located adjacent the rest position of the interface means, and preferably, when the interface means is a read and/or write head, the cleaning means is located at a position which corresponds to the first track of a data carrier which is normally read by the read and/or write head.

Preferably, when the read and/or write unit is a disc drive unit, the carrier means defines a central axis, which when the cleaning device is located in a disc receiving area of the disc drive unit coincides with the rotational axis of a disc when placed in the disc receiving area.

In one embodiment of the invention the cleaning means extends completely around the central axis defined by the carrier means.

Preferably, the cleaning means comprises a cleaning brush having a plurality of

fibres extending towards the component when the cleaning brush is aligned with the component.

In another embodiment of the invention the fibres of the cleaning brush are angled relative to the carrier means for engaging the surface of the component at an acute angle for enhancing cleaning and scrubbing of the component.

In another embodiment of the invention the fibres of the cleaning brush are provided by picks or tufts, each pick or tuft being formed by a plurality of filaments, which preferably, are grouped together, by twisting or otherwise to form the pick or tuft. Advantageously, the filaments are texturized for further enhancing cleaning and scrubbing of the component, and for increasing the surface area of the filaments available for contacting the component.

In a further embodiment of the invention the cleaning brush is resiliently mounted on the carrier means, and preferably, is mounted on the carrier means by a resilient mounting means.

In one embodiment of the invention the cleaning means defines an area which is at least substantially similar to the area of the component to be cleaned for facilitating nesting of the component to be cleaned into the cleaning means when the disc drive unit is not in use for protecting the component from dirt, dust, and other debris.

Preferably, the area of the cleaning means is greater than the area of the

component to be cleaned for further facilitating nesting of the component in the cleaning means so that a portion of the cleaning means extends circumferentially around the component to be cleaned for substantially acting as a cap for protecting the component from dirt, dust and other debris.

Preferably, the fibres of the cleaning brush form a pile into which the component can be nested.

In one embodiment of the invention the cleaning device is adapted for cleaning a lens of a read and/or write head of an optical disc drive unit, and preferably, the cleaning means is located on the carrier means at a location which corresponds to the location of the read and/or write head when the disc drive unit is not in use. In one embodiment of the invention the cleaning means is located on the carrier means at a position which corresponds to an inner track of an optical disc of the type for use in the optical disc drive unit.

In a further embodiment of the invention the cleaning means is adapted for cleaning a read and/or write head of an optical disc drive unit which comprises a pair of lenses, one lens being provided for audio and the other lens being provided for DVD. Ideally, the cleaning means is of area for embracing both lenses, for substantially acting as a cap for protecting the two lenses when the disc drive unit is not in use.

Additionally, and/or alternatively, the cleaning device is adapted for cleaning the lenses of a read/write head and/or the respective lenses of a read head and a

write head of an optical disc drive unit, the area of the cleaning means being such as to facilitate the cleaning means acting as a cap for protecting the respective lenses when the disc drive unit is not in use.

In a further embodiment of the invention the carrier means is provided by a carrier disc of dimensions similar to an optical or magnetic disc or other disc of the type for which the disc drive unit is adapted to receive.

The invention will be more clearly understood from the following description of some embodiments thereof which are given by way of example only with reference to the accompanying drawings, in which:

Fig. 1 is a perspective view of a cleaning device according to the invention,

Figs. 2(a) and (b) are transverse cross-sectional end elevational views of a portion of the cleaning device of Fig. 1 in use,

Fig. 3 is a perspective view of a cleaning device according to another embodiment of the invention,

Fig. 4 is a transverse cross-sectional end elevational view of a portion of the cleaning device of Fig. 3,

Fig. 5 is a perspective view of a cleaning device according to a further

embodiment of the invention,

Fig. 6 is a transverse cross-sectional end elevational view of a portion of the cleaning device of Fig. 5,

Fig. 7 is a perspective view of a cleaning device according to another embodiment of the invention,

Fig. 8 is a transverse cross-sectional side elevational view of a portion of the cleaning device of Fig. 7 in use on the line VIII-VIII of Fig. 7,

Fig. 9 is an enlarged perspective view of a portion of the cleaning device of Fig. 7,

Fig. 10 is an enlarged top plan view of the portion of Fig. 9, and

Fig. 11 is an enlarged underneath plan view of the portion of Fig. 9.

Referring to the drawings and initially to Figs. 1 and 2 there is illustrated a cleaning device according to the invention indicated generally by the reference numeral 1 for cleaning a component of an interface means, namely, a lens 2 of an optical head (not shown) of an optical disc drive unit (also not shown). The arrangement and construction of such optical disc drive units will be well known to those skilled in the art, and it is not intended to describe the construction of such disc drive units in further detail, other than to say such disc drive units

comprise a disc receiving area for receiving an optical disc, which, depending on the disc drive unit may be a CD ROM, a music CD, a DVD disc or other such optical disc. The optical head is located adjacent the disc receiving area for focusing laser light through the lens 2 onto the disc for reading and/or writing thereof.

The cleaning device 1 comprises a carrier means, namely, a carrier disc 5 which in this embodiment of the invention is of the same shape and size of an optical disc for which the optical disc drive unit is adapted to receive, and is of a plastics material. A central opening 6 in the carrier disc 5 defines a central axis of the carrier disc 5 which in use coincides with the rotational axis of an optical disc when loaded into the disc receiving area of the optical disc drive unit. The central opening 6 is adapted for engaging the drive spindle of the optical disc drive unit in the disc receiving area.

A cleaning means provided by a cleaning brush 10 is located on the carrier disc 5 and extends around a track 11 which coincides with the inner track of an optical disc so that when loaded into the disc receiving area of the cleaning device 1 with the central opening 6 engaged by the drive spindle of the optical disc drive unit the cleaning brush 10 is aligned with the rest position of the optical head (not shown). The cleaning brush 10 is formed by a plurality of fibres 12 which extend from a backing sheet 14, which in turn is secured by adhesive to the carrier disc 5. The fibres 12 are of length such that as the head is being moved for adjusting the focus, in other words, is being cycled in the direction of the arrows A and B towards and away from the carrier disc 5, respectively, the

lens 2 is urged into and out of the fibres 12 for cleaning thereof, see Fig. 2. Additionally, the fibres 12 do not extend perpendicularly from the carrier disc 5, but rather at an angle greater than zero to the perpendicular so that they engage a major surface 15 of the lens 2 at an acute angle for facilitating wiping of the fibres 12 across the surface 15 of the lens 2, and in turn for facilitating a scrubbing action by the fibres 12 on the surface 15 of the lens 2. A further advantage of angling the fibres 12 to the carrier disc 5 is that the force required to cause the fibres 12 to flex for causing the fibres 12 to wipe across the lens 2 is significantly reduced. The force available for cycling the head towards and away from the carrier disc 5 during focusing is relatively weak, and accordingly, the fibres 12 are chosen to be of such flexibility and resilience to flex under the action of the lens 2 being urged into and out of the brush 10 during the focus cycling action. In this embodiment of the invention the fibres 12 of the brush 10 are formed by picks or tufts, each of which comprises a plurality of texturized filaments of polyamide - 6.6, and filament diameter 2.2 DTEX (denier). Typically, each tuft is made up of approximately fifty filaments which are grouped together and may be twisted together. The cleaning brush 10 comprises one pick or tuft per square millimetre. The texturizing of the filaments is carried out by heating and provides the filaments and in turn the picks or tufts with an inherent resilience which enhances the cleaning action.

In use, the cleaning device 1 is loaded into the disc receiving area of the optical disc drive unit, the lens 2 of the optical head of which is to be cleaned. The optical disc drive unit is then activated, and on activation, the head commences to focus on the carrier disc 5 by cycling in the directions of the arrows A and B.

Since the cleaning brush 10 is aligned with the rest position of the optical head, this cycling action of the head urges the lens 2 into and out of the cleaning brush 10, which thereby causes the fibres 12 of the cleaning brush 10 to wipe across the surface 15 of the lens 2 with a scrubbing action for cleaning the surface 15 and adjacent parts of the head. In general, the optical head will continue the cycling action for some time in an attempt to focus on and to read data thereon. During this time of focusing, the head and thus the lens 2 continues to cycle inwardly and outwardly into and out of the cleaning brush 10, thereby causing the cleaning brush 10 to clean the lens 2. However, after some time of failing to detect the presence of an optical disc or data thereon, the optical head ceases the cycling action. At that stage the cleaning device 1 is withdrawn, and a conventional optical disc is loaded into the optical disc drive unit. If the lens 2 has been adequately cleaned, the optical disc drive unit will then operate with the optical disc loaded therein. If the lens 2 has not been adequately cleaned, then the cleaning device 1 is again loaded into the disc receiving area of the optical disc drive unit which again is activated for causing the head to commence the cycling action for further cleaning of the lens 2. This loading and reloading of the cleaning device 1 is continued until the lens 2 is adequately cleaned. It is envisaged that in the event of a particularly dirty lens, a liquid cleaning solution may be applied to the cleaning brush 10 for softening the dirt on the lens 2.

Referring now to Figs. 3 and 4 there is illustrated a cleaning device according to another embodiment of the invention indicated generally by the reference numeral 20 for cleaning a lens 2 of an optical head of an optical disc drive unit.

The cleaning device 20 is substantially similar to the cleaning device 1 and similar components are identified by the same reference numerals. The main difference between the cleaning device 20 and the cleaning device 1 is that the cleaning brush 10, instead of being mounted directly on the carrier disc 5 is carried on four resilient carrier members 21 which extend generally radially from the carrier disc 5 for further enhancing cleaning of the lens 2. The cleaning brush 10 comprises a base ring 23 which is carried on the resilient carrier member 21, and fibres 12 extending from the base ring 23. The base ring 23 extends around the carrier disc 5 at a location corresponding to an inner track of an optical disc so that when the cleaning device 20 is located into the disc receiving area the optical head is aligned with the cleaning brush 10. Additionally, in the cleaning device 20 the angle at which the fibres 12 of the cleaning brush 10 approach the surface 15 of the lens 2 is slightly more acute than the angle at which the fibres 12 approach the lens 2 of the cleaning device 1. This, it is believed further enhances the wiping and scrubbing action of the fibres 12 on the lens 2 and further reduces the force which is required for urging the lens into the cleaning brush 10.

The carrier members 21 are of a plastics resilient material and terminate in tabs 24 and 25 which are secured to the carrier disc 5 and the base ring 23, respectively by adhesive. Accordingly, as the head urges the lens 2 into the cleaning brush 10 as well as the fibres 12 flexing for wiping and scrubbing the lens 2, the brush 10 also moves in the directions of the arrows C and D under the inherent resilience of the carrier members 21.

Referring now to Figs. 5 and 6 there is illustrated a cleaning device according to a further embodiment of the invention indicated generally by the reference numeral 30 for cleaning a lens 2 of an optical head of an optical disc drive unit. The cleaning device 30 is substantially similar to the cleaning device 1 and similar components are identified by the same reference numerals. The main difference between the cleaning device 30 and the cleaning device 1 is that the brush comprises a backing member 31 from which the fibres 12 extend which is of a resilient material. This facilitates movement of fibres 12 in the directions of the arrows C and D as the lens is cycled in the directions of the arrows A and B towards and away from the brush 10 during focusing. The provision of the resilient base member 31 further enhances cleaning of the surface 15 of the lens 2. Additionally, the base member 31 is located in a recess 32 formed in the carrier disc 5. Additionally, the length of the fibres 12 of the cleaning brush 10 are such that when the optical head is in the rest position with the optical disc drive unit not in use, the lens 2 nests into the fibres of the cleaning brush 10.

A further difference between the cleaning device 30 and the cleaning device 1 is that the radial width of the cleaning brush 10 of the cleaning device 30 is greater than the corresponding radial width of the cleaning brush 10 of the device 1. The width of the cleaning brush 10 in this embodiment of the invention is such that when the cleaning device is loaded into the disc receiving area of a disc drive unit and the optical head of the disc drive unit is in the rest position the lens 2 and a portion of the optical head adjacent the lens 2 nests into the fibres 12 of the cleaning brush 10. Furthermore, the fibres 12 of the brush 10 extend around the periphery of the lens 2 and a portion of the read/write head adjacent the lens

2 so that the brush 10 effectively forms a cap for protecting the lens 2 of the optical head from dust and dirt when the optical disc drive unit is not in use. The advantage of this aspect of the invention is that the cleaning device can be used as a protective device for protecting the lens of the optical head from dirt and other debris when the optical disc drive unit is not in use. Additionally, if the fibres of the brush 10 are of sufficient resilience, the cleaning device 30 according to this embodiment of the invention can also act as a protective device for protecting the optical head from shock when the optical disc drive unit is not in use.

Otherwise the cleaning device 30 and its operation is similar to that of the cleaning device 1.

Referring now to Figs. 7 to 10 there is illustrated a cleaning device according to a further embodiment of the invention indicated generally by the reference numeral 40 for cleaning a lens 2 of an optical head of an optical disc drive unit. The cleaning device 40 is substantially similar to the cleaning device 1 and similar components are identified by the same reference numerals. The main difference between the cleaning device 40 and the cleaning device 1 is that instead of a cleaning brush being provided which extends circumferentially around the carrier disc 5, a cleaning brush 41 of circular shape is carried on a resilient carrier arm 42. The carrier arm 42 is of resilient plastics material and is secured by adhesive or other suitable securing means to a rear surface 44 of the carrier disc 5. An opening 45 through the carrier disc 5 accommodates the cleaning brush 41 through the carrier disc 5. The cleaning brush 41 comprises a

backing disc 46 of plastics material which is integrally formed with the carrier arm 42. The fibres 12 of the cleaning brush 41 are secured in and extend from the backing disc 46 through the opening 45 for engaging the lens 2 to be cleaned. The cleaning brush 41 is located on the carrier disc 5 so that when the carrier disc 5 is engaged in the disc receiving area the cleaning brush 41 can be aligned with the optical head when the optical head is in the rest position. Additionally, the fibres 12 of the cleaning brush 41 are of sufficient length that when the optical head is in the rest position with the optical disc drive deactivated, the lens 2 is nested into the fibres 12 of the cleaning brush 41 as can be seen in Fig. 8 to act as a cap to protect the lens 2 from dirt, dust and other debris when the optical disc drive unit is not in use. The fibres 12 of the cleaning brush 41 are similar to those of the cleaning device 1 and are formed by tufts or picks.

In this embodiment of the invention as well as having a cleaning function, the cleaning brush 41 also has a protective function for protecting the lens 2 of the optical head from dust, dirt and other debris, when the optical disc drive unit is not in use. The area of the cleaning brush 41 in plan view, in other words, the area of the cleaning brush 41 in plan view defined by the fibres 12 is slightly greater than the area of the major surface 15 of the lens 2 so that when the optical disc drive unit is not in use, the lens 2 can nest into the fibres 12 of the cleaning brush 41 with the peripheral fibres of the cleaning brush 41 extending circumferentially around the lens 2 as illustrated in Fig. 8 for embracing the lens 2. In this way the cleaning brush 41 essentially acts as a cap for protecting the lens 2 from dirt, dust and other debris when the optical disc drive unit is not in

use. Additionally, in this embodiment of the invention if the fibres 12 of the cleaning brush 41 are of sufficient resilience the cleaning device further acts as a protective device for protecting the optical head from shock.

Accordingly, in use the cleaning device 40 is located in the disc receiving area of an optical disc drive unit with the cleaning brush 41 aligned with the lens 2 of the optical head. Ideally, the cleaning device 40 is left in the disc receiving area of the optical disc drive unit when the optical disc drive unit is not in use, and is removed when it is desired to insert an optical disc in the disc receiving area. However, ideally, prior to removing the cleaning device 40 from the disc receiving area the optical disc drive unit is activated to play an optical disc, thus causing the optical head and in turn the lens 2 to be cycled inwardly and outwardly into and out of the cleaning brush 41 for cleaning the lens 2 of the optical head so that the lens is clean when the optical disc to be played is inserted in the disc receiving area.

It will of course be appreciated that when inserting the cleaning device 40 into the disc receiving area of the optical disc drive player the cleaning device 40 will be inserted so that when fully inserted into the disc receiving area the cleaning brush 41 will be aligned with the lens of the optical head, when the optical head is in the rest position. It is envisaged in certain cases that a guide means may be provided for guiding the cleaning device 40 into the disc receiving area with the cleaning brush 41 aligned with the lens of the optical head.

The advantages of the cleaning devices according to the invention are many. In

particular, the cleaning devices 1, 20, 30 and 40 are particularly suitable for cleaning excessively dirty lenses, which are so dirty as to prevent rotation of a carrier disc of a cleaning device within the disc receiving area. Cleaning of the lens is entirely carried out during the focusing action of the optical head. A particularly important advantage of the cleaning devices 30 and 40 according to the invention is that as well as acting as a cleaning device the cleaning device also acts as a protective cap for protecting the lens of the optical head when the optical disc drive unit is not in use. Furthermore, since the lens and thus a part of the optical head are nested into the cleaning brush, the cleaning brush acts to protect the optical head from shock when the optical disc drive unit is not in use.

It is envisaged that while the fibres of the cleaning brushes have been described as being formed by tufts or picks of texturized filaments, any other suitable fibres may be provided, although, it is preferable that the fibres should have some degree of inherent resilience for enhancing the cleaning action. It will be appreciated that the fibres instead of being angled may be arranged to extend towards and engage the surface of the component to be cleaned perpendicularly. Needless to say, each tuft or pick may have any desired number of filaments, and needless to say the filaments may be of any other suitable size or material.

While the cleaning brush of the cleaning device 40 has been described as being resiliently mounted on the carrier disc, the cleaning brush may be rigidly mounted in certain cases if desired.

It of course will be appreciated that while it is desirable it is not essential that the carrier means be provided by a carrier disc, any other suitable carrier means may be provided.

While the cleaning devices have been described for cleaning the lens of an optical head of an optical disc drive unit, it is envisaged that the cleaning device may be adapted for cleaning a magnetic read/write head of a magnetic disc drive unit. Needless to say, it will be appreciated that the cleaning devices may be provided for cleaning any other component in an optical and/or read/write head of a disc drive unit. It is also envisaged that the cleaning devices may be provided for cleaning optical heads and/or read/write heads with two or more lenses. Where the lenses are located adjacent each other, it is envisaged that in the case of the cleaning device 40 the cleaning brush will be of area in plan greater than the combined area defined by the two lenses. Needless to say, where a disc drive unit is provided with two heads, one for reading and one for writing, where the heads are located adjacent each other the area of the cleaning brush of the cleaning device 40 will be of area greater than the combined area defined by the lenses of the two heads.

Where the cleaning device is being provided for cleaning more than one lens of a disc drive unit, and the lenses are spaced apart, it is envisaged that a cleaning brush may be provided for each lens in the case of the cleaning device 40. Needless to say, the radial width of the cleaning brushes of the cleaning devices 1 and 20 will likewise be of sufficient width to engage and encompass the lenses where it is desired that the cleaning brushes of the cleaning devices 1 and 20

are also to act as a protective cap similar to the action of the cleaning brushes of the cleaning devices 30 and 40.

It is envisaged that the cleaning device 40 may be particularly suitable for use in portable optical disc drive units.

The invention is not limited to the embodiments hereinbefore described which may be varied in construction and detail.

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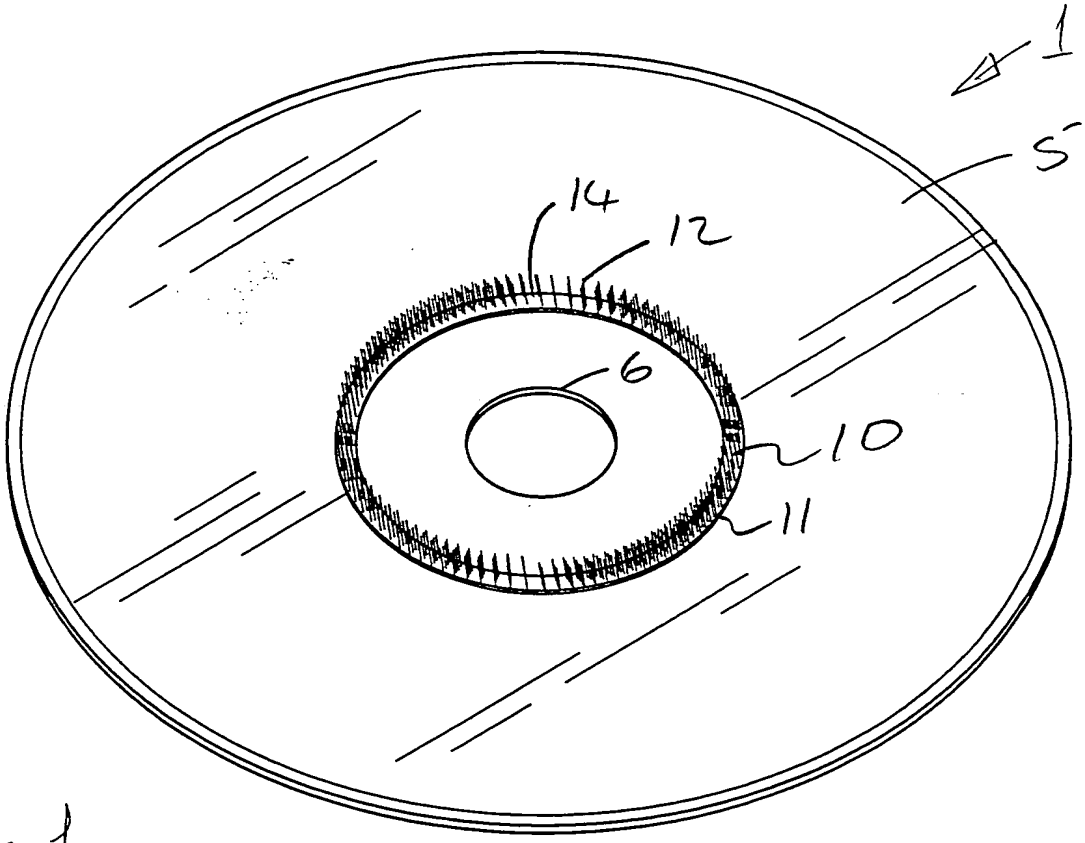

Fig 1

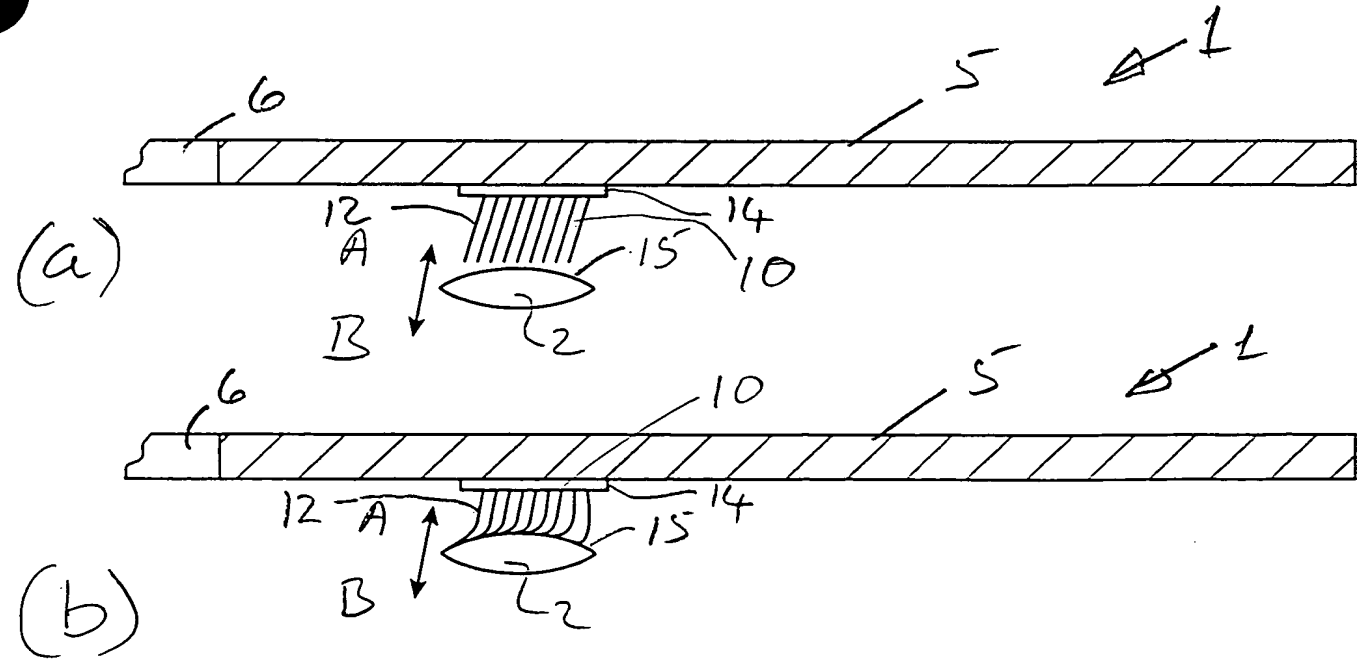

Fig 2

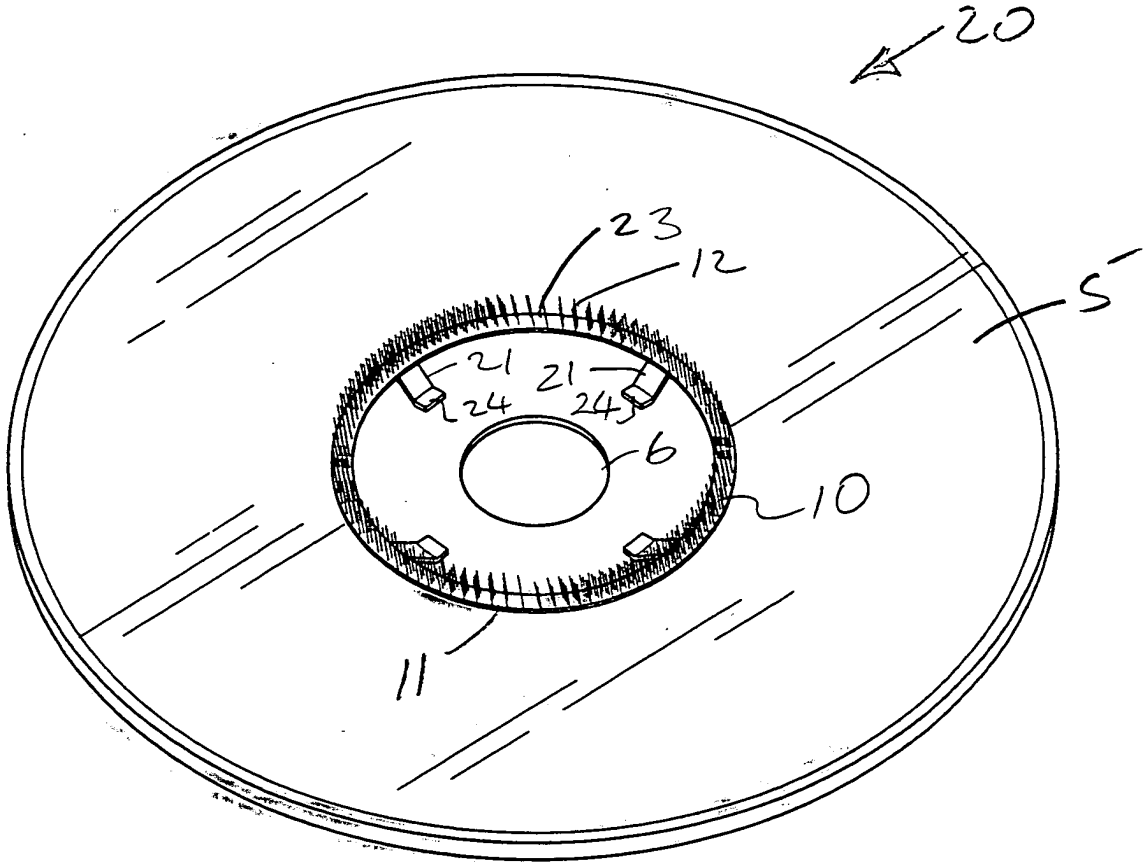

FIG 3

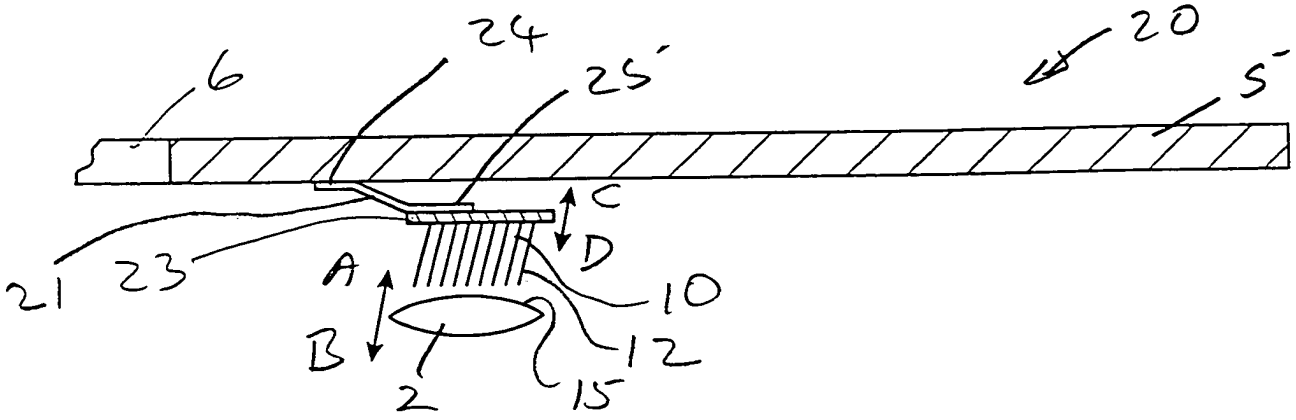

FIG 4

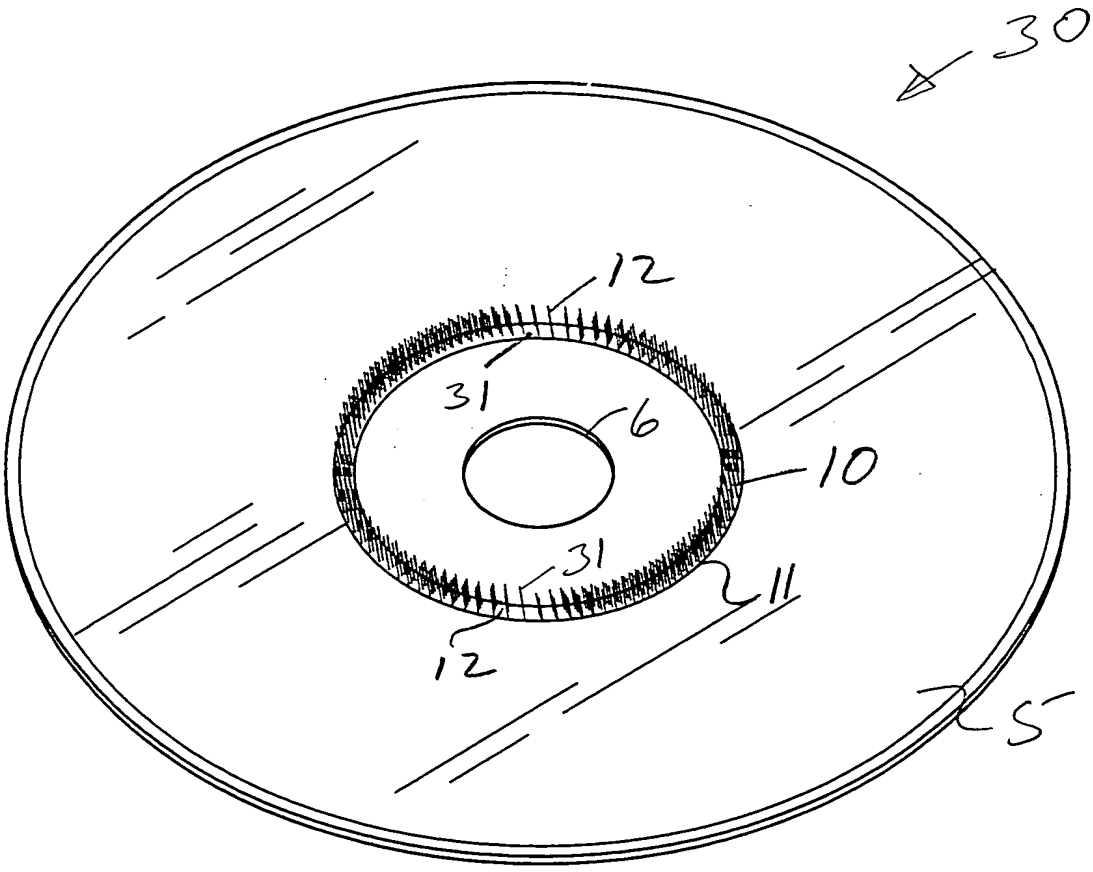

FIG 5

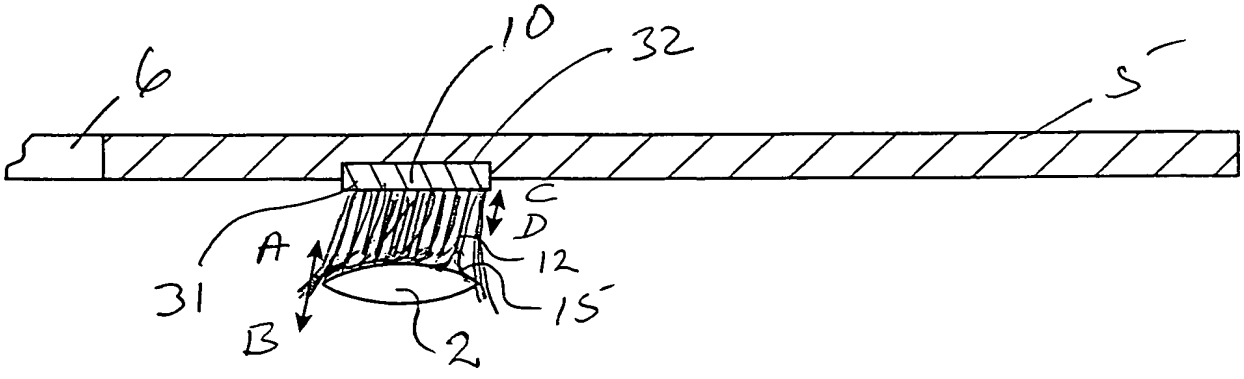

FIG 6

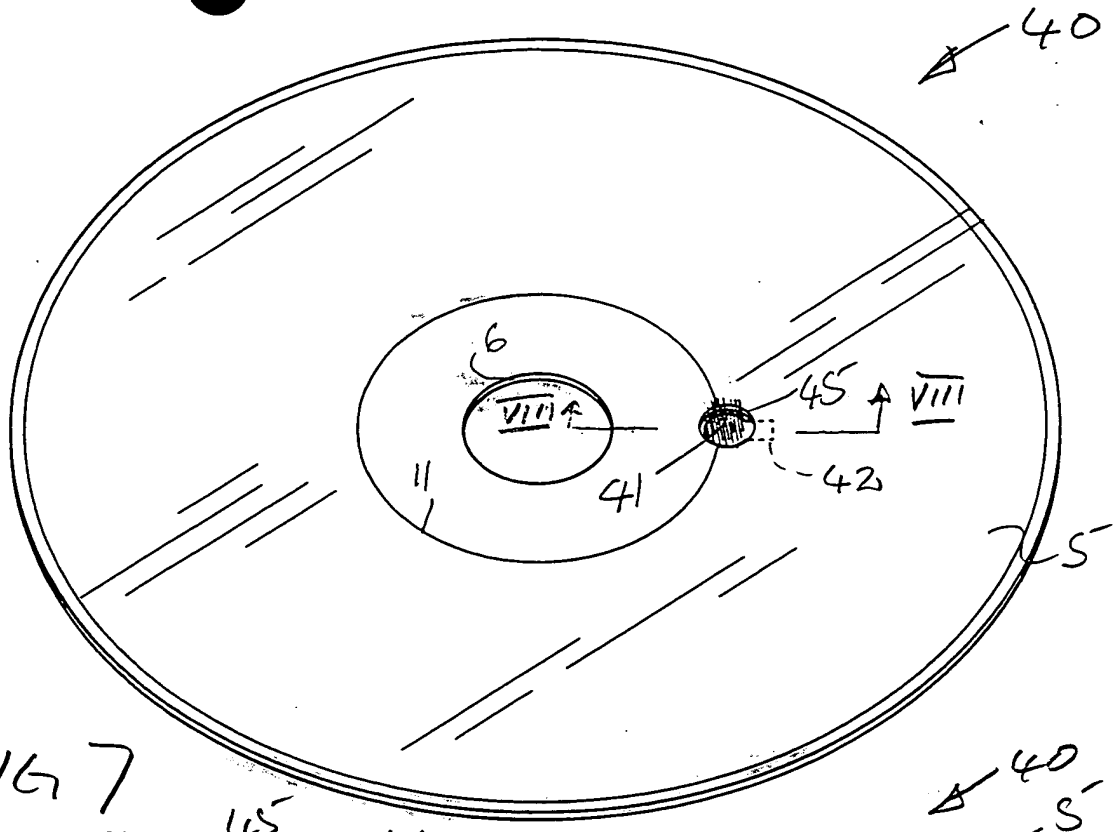

FIG 7

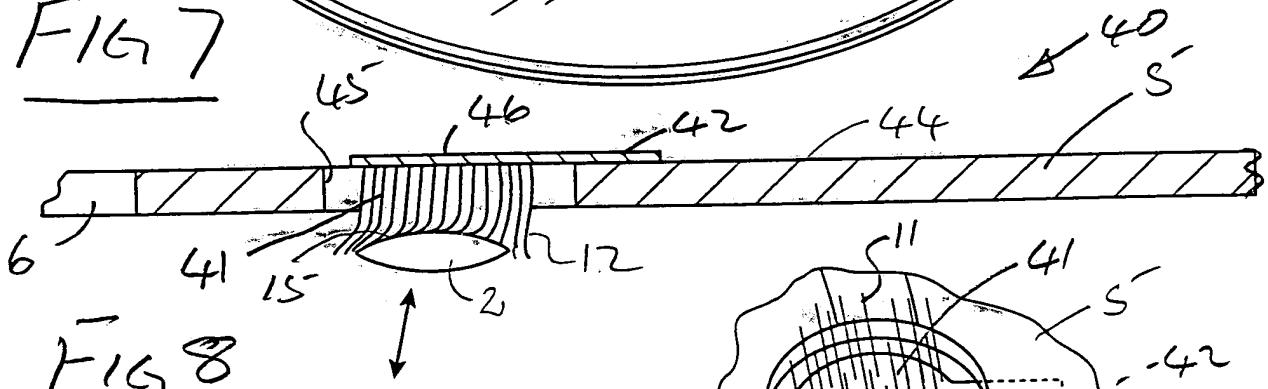

FIG 8

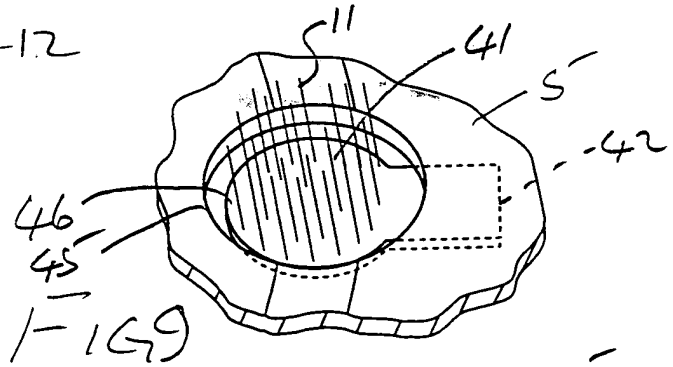

FIG 9

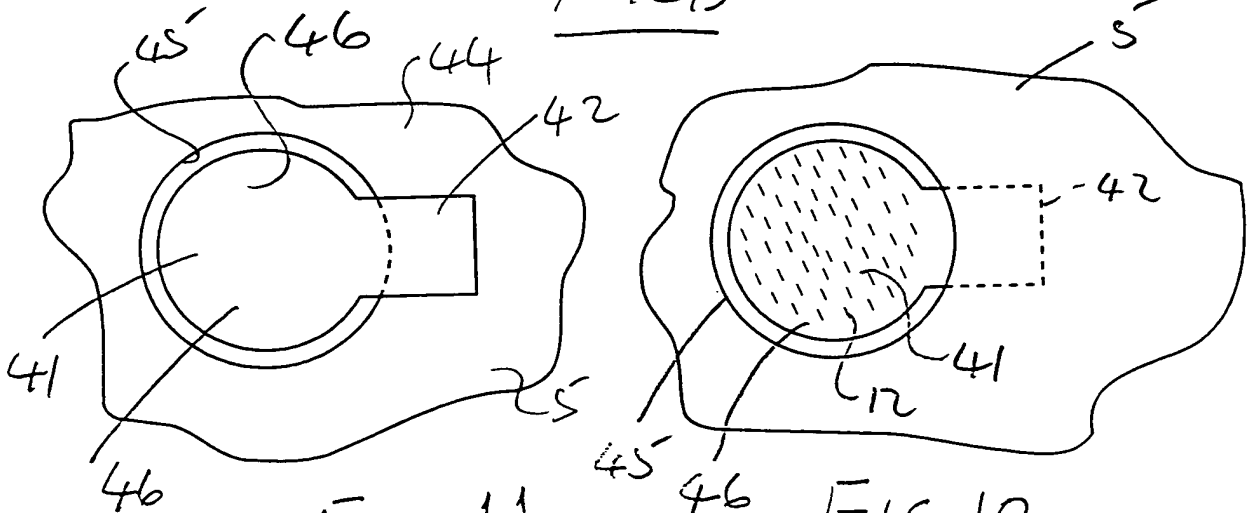

FIG 11

FIG 10